Space Weather Forecast

Issued on Thursday, 10 August 2023 at 13:05 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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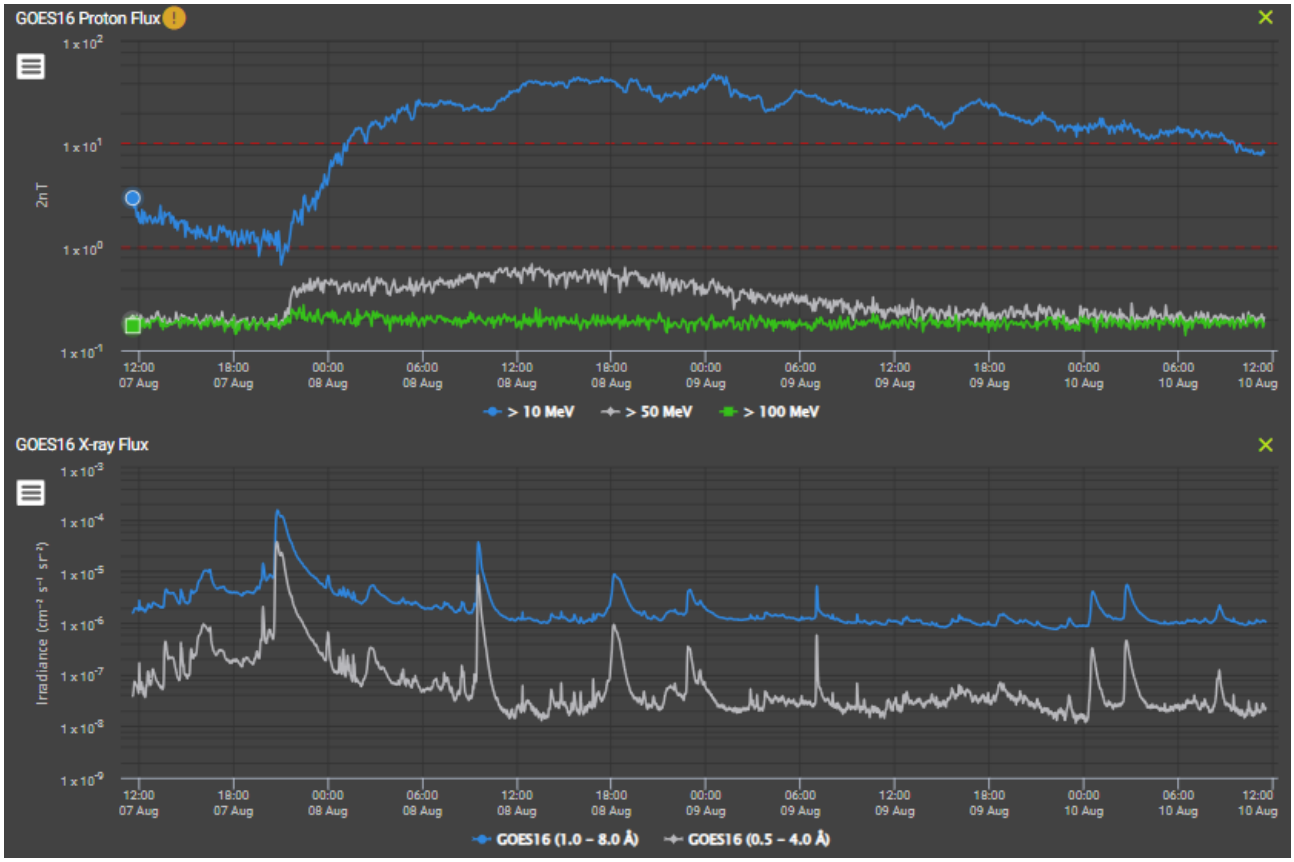
Space Weather Forecast Headline: S1 Minor solar radiation storm has now waned.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the past 24 hours, with occasional Common-class flares observed. These flares peaked with a mid-ranking flare at 10/0242UTC from the southwestern solar horizon, perhaps containing the faded remnant of an earlier sunspot. The main other noteworthy flare was from an active region nearer the middle of the Sun at 10/0032UTC.

Figure 1: Past 72 hours in high energy proton flux spectrum (top) and linked X-ray flares (bottom). These show a long-lasting 47pfu peak response (top blue 10MeV line) to the Strong-class flare late on 07 August. This has now finally fallen below the S1 Minor Solar Radiation Storm threshold (10pfu, red-dashes – note the scale is logarithmic. Note also that the 1pfu red dotted line is for 100MeV protons which were relatively unmoved by this event). Further such enhancements are now much less likely and fall with time.



There are now up to five surviving sunspot regions on the facing side of the Sun, with three of

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these small and magnetically unipolar. The most significant groups were both near the central solar meridian.

There were three main noted Coronal Mass Ejection (CME)-generating events in the period. Firstly, a large plume of ejecta was visible well past the western solar horizon around 09/1530UTC on roughly the latitude of a large sunspot group that crossed the western horizon early this week, although any attribution is speculative. This may have led to a 'filament' eruption (arc of plasma) in its aftermath, however both appear far-sided and are not thought to have any Earth-bound component.

The second event was tied to the aforementioned peak flare of the 24 hours on the southwestern solar horizon. Modelling has been submitted for this, and although results are not yet available, any Earth-directed component appears unlikely.

Thirdly, a large filament gradually released in the far south of the facing side of the Sun around 10/0600UTC. This feature is now becoming visible in satellite imagery, although being very low latitude this is tentatively considered likely to miss.

At the time of writing therefore, no Earth-directed CMEs have been identified.

Solar Wind / Geomagnetic Activity: The solar wind was mostly reflective of a slow regime, perhaps with a very minor embedded CME (in both duration and magnitude). The source of this is not known, but given its extremely brief tenure, it may be an extreme glance from the trailing edge of a side lobe from one of the mainly west-directed CMEs from the period 04-06 August.

The solar wind speed fell from slightly elevated to background levels through the period. The number of particles in the wind rose in the first half of the period to also become slightly elevated, peaking near 09/1900UTC, before waning back to typical background. This was matched by a minor discontinuity in their associated magnetic field, with a visible change in character. The trace became more smooth between 09/2000-10/0400UTC, whereupon the previous more erratic tendencies once again took over. The north-south component was smaller still in magnitude, again with the change of character evident between the times stated.
The net result of the above solar wind measures was for nevertheless quiet geomagnetic conditions throughout.

Energetic Particles / Solar Radiation: Solar radiation storm levels showed the ongoing tail of a response to the Strong-class flare peaking at 07/2046UTC from a large sunspot group now long-past the western solar horizon, perhaps with minor re-enhancements from flares from a second large group to its immediate east. Having peaked at 47pfu early on 09 August, levels now lie near the 10pfu (S1, Minor Solar Radiation Storm) boundary at the time of writing.

Four-Day Space Weather Forecast Summary

Solar Activity: Low levels of solar activity are anticipated, with only a slight chance of further Moderate-class flares. No significant regions depart in the period, and while there are far-side soundings suggesting arrivals, any assessment as to their potency is withheld until they present for analysis. The flare risk is therefore constant throughout.

Solar Wind / Geomagnetic Activity: No fast winds nor Earth-bound CMEs feature in the forecast, and mainly quiet conditions should therefore persist throughout.

Energetic Particles / Solar Radiation: The risk of further S1 Minor Solar Radiation Storms should continue to very gradually ease towards a residual background level over the coming UTC weekend, i.e. a daily slight chance. In the interim, risks are maintained higher due to current

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elevated levels in the near-Earth environment (i.e. requiring little further impetus from new flares) and the presence of the historically prolific large sunspot group on the far western side of the Sun.

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	40	20	10	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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